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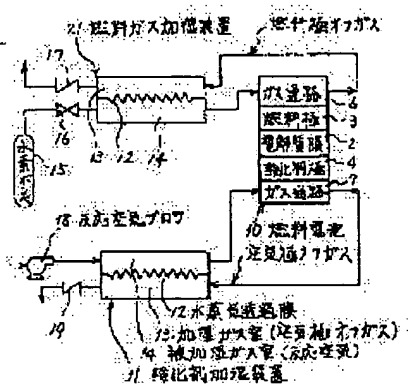
## (54) SOLID HIGHPOLYMER ELECTROLYTE TYPE FUEL CELL

(57)Abstract:
PURPOSE: To provide a solid highpolymer electrolyte type fuel cell equipped with a reaction gas humidifier in which the stable amount of humidification is obtained in accordance with a change in the amount of reaction gas, the miniaturization and the capacity increase of which is easy to make.
CONSTITUTION: The stack 10 of a solid highpolymer electrolyte type fuel cell is constituted by laminating plural layers unit cells 1 including a solid high polymer film 2, a fuel electrode 3 and an oxidant electrode 4 through a bipolar plate having reaction gas passages 6, 7 made of recessed grooves. Reaction gas humidifiers 11, 21, are provided, which are equipped with a vapor permeation film 12, a gas humidification chamber 13 defined by the film 12 and a chamber 14 for gas to be humidified, and which humidify reaction gas while off-gas exhausted from a reaction gas passage is used as humidification gas and reaction gas supplied to the reaction gas passage is used as gas to be humidified.



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* NOTICES *

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CLAIMS

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[Claim]
[Claim 1] The single cell which consists of a solid-state poly membrane which has ion conductivity, and the propellant electrode and oxidizer electrode which were allotted to the both sides by sticking In the thing which comes to carry out two or more layers laminating through the bipolar plate which has the reactant gas path which becomes the fraction which counters the aforementioned propellant electrode of both sides of a gas impermeability plate, and each oxidizer electrode from a concave It has a steam transparency layer, and the humidification gas chamber and the humidified gas chamber which were ****ed by this steam transparency layer. The solid-state polyelectrolyte type fuel cell characterized by coming to prepare the reactant gas humidification equipment which makes humidified gas the reactant gas which supplies the offgas discharged from the aforementioned reactant gas path to humidification gas and the aforementioned reactant gas path, and humidifies reactant gas.
[Claim 2] The solid-state polyelectrolyte type fuel cell of the claim 1 publication characterized by forming and becoming so that the reaction air which the humidification gas chamber of reactant gas humidification equipment ****ed to the outlet side of an oxidizer path, introduced air pole offgas, and the humidified gas chamber ****ed and humidified to the entrance side of an oxidizer path may be supplied to an oxidizer path.
[Claim 3] The solid-state polyelectrolyte type fuel cell of the claim 1 publication characterized by forming and becoming so that the fuel gas which the humidification gas chamber of reactant gas humidification equipment ****ed to the outlet side of a fuel gas path, introduced fuel-electrode offgas, and the humidified gas chamber ****ed and humidified to the entrance side of a fuel gas path may be supplied to a fuel gas path.

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DETAILED DESCRIPTION

[Detailed description]
[0001]
[Field of the Invention] This invention relates to the solid-state polyelectrolyte type fuel cell which used the solid-state poly membrane as an electrolyte layer, and the humidification structure of the reactant gas for humidifying a solid-state poly membrane especially.
[0002]
[Prior art] Drawing 2 is the cross section in which, and showing it, and the single cell 1 consists of a solid-state poly membrane 2 which has ion conductivity, and the propellant electrode (anode electrode) 3 and the oxidizer electrode (cathode electrode) 4 supported so that it might stick to the both sides. [ the single cellular structure of a solid-state polyelectrolyte type fuel cell ] [ **] [ type ] Moreover, the bipolar plate 5 which ****s the single cell 1 consists of a gas impermeability plate which has conductivity. By supplying the oxygen or reaction air as an oxidizer to the oxidizer path 7 formed in the field side which touches the oxidizer electrode 4 in the hydrogen as fuel gas at the fuel gas path 6 formed in the field side which touches the propellant electrode 3 as a concave as a concave Power generation based on electrochemical reaction is performed by inter-electrode [ of the couple of the single cell 1 ]. In addition, the solid-state polyelectrolyte type fuel cell of desired output voltage is obtained by carrying out two or more layers laminating of the single cell 1 and the bipolar plate 5 to less than [ 1V ], since the output voltage of the single cell 1 constituted in this way is low, and constituting a stack.
[0003] On the other hand as a solid-state poly membrane 1 which has ion conductivity For example, the thing using the par fluorocarbon sulfonic-acid layer (the U.S., Du Pont, tradename Nafion) which is a proton exchange layer as an electrolyte layer is known. It is 20ohm-cm at ordinary temperature by having and carrying out the saturation water of the proton (hydrogen ion) exchange group into a molecule. While the following specific resistances are shown and functioning as a proton conductivity electrolyte, it functions also as a diaphragm which prevents mixture of fuel gas and oxidizer gas. Namely, the anode reaction (H2 ->2H++2e-) which decomposes a hydrogen molecule into a hydrogen ion and an electron in an anode electrode (propellant electrode) side A cathode reaction is performed, respectively. in a cathode electrode (oxidizer electrode) side, water is generated from oxygen, a hydrogen ion, and an electron -- electrochemical reaction (2H++1/2 O2+2e-->H2 O) -- Electrochemical reaction which becomes H2+1/2 O2 ->H2 O collectively is performed, and generated output is supplied to a load by the electron which moves toward a cathode from an anode in an external circuit.
[0004] As mentioned above, while the inside of the solid-state poly membrane 2 is maintained in the saturation water status in order to maintain highly the generating efficiency of a solid-state polyelectrolyte type fuel cell since a layer functions as a proton exchange layer when solid-state polyelectrolyte type ********** carries out the saturation water of the electrolyte layer, it is 50-100 degreeC about the operating temperature of a solid-state polyelectrolyte type fuel cell. It is necessary to hold to a grade and to keep low the specific resistance of a solid-state poly membrane. For this reason, after the solid-state polyelectrolyte layer 2 of each ** cell 1 has carried out the water of the water of a saturation content beforehand, assembly operation of a stack is performed. However, if it generates electricity by raising an operating temperature to the above-mentioned temperature requirement, a xeransis operation of the solid-state poly membrane 2 shown below occurs, the solid-state poly membrane 2 cannot be maintained in the saturation water status, but the problem that the generating efficiency of a solid-state polyelectrolyte type fuel cell falls will occur. Namely, proton 2H+ generated in the anode reaction while the water generated by electrochemical reaction by fuel gas and oxidizer gas was carried out out of the system In case the inside of a solid-state poly membrane is turned to a cathode from an anode and it moves, a child's water carries out orientation several minutes, it moves to a proton together, and xeransis of a solid-state poly membrane advances by being carried out out of a system with fuel gas and an oxidizer.
[0005] Then, in order to avoid such a situation, water is added to the reactant gas (fuel gas and oxidizer) supplied to the reactant gas paths 6 and 7, the steam concentration in reactant gas (steam partial pressure) is raised, and what was constituted so that vaporization of the moisture from the solid-state poly membrane 2 might be suppressed is known. The bubbling humidifying method which supplies the reactant gas which formed the humidifier which collected the molten metal heated more than the operating temperature of a fuel cell or it in the exterior of a fuel cell, **********ed reactant gas in the warm water of this humidifier, humidified, and was humidified as the humidification technique of reactant gas to each ** cell of a solid-state polyelectrolyte type fuel cell is learned.
[0006]

[Object of the Invention] In the humidification technique using an above-mentioned bubbling formula humidifier Since it is necessary to adjust the amount of bubblings of the gas in a humidifier according to the amount of supply of reactant gas, while a solid-state polyelectrolyte type fuel cell large-sized-izes and a humidifier large-sized-izes corresponding to the increase of the amount of bubblings, and this The problem that the control supplied without retardation became difficult was in the fuel cell in the status that controlled the amount of bubblings corresponding to change of the load of a fuel cell, and it humidified enough.

[0007] Moreover, it needed to ask for the heat source for holding the water temperature of a humidifier more than an operating temperature and an EQC, and water supply outside, and there was also a problem that the thermal efficiency as a solid-state polyelectrolyte type fuel cell fell. It is in the amount of humidification stabilized with respect to change of the amount of reactant gas that there is nothing being obtained, and the purpose of this invention obtaining the solid-state polyelectrolyte type fuel cell equipped with the reactant gas humidification equipment in which a miniaturization and large-capacity-izing are possible.

[0008]

[The means for solving a technical problem] The solid-state poly membrane which has ion conductivity according to this invention in order to solve the above-mentioned technical probrem, The single cell which consists of the propellant electrode and oxidizer electrode which were allotted to the both sides by sticking In the solid-state polyelectrolyte type fuel cell which comes to carry out two or more layers laminating through the bipolar plate which has the reactant gas path which becomes the fraction which counters the aforementioned propellant electrode of both sides of a gas impermeability plate, and each oxidizer electrode from a concave It has a steam transparency layer, and the humidification gas chamber and the humidified gas chamber which were ****ed by this steam transparency layer. It shall come to prepare the reactant gas humidification equipment which makes humidified gas the reactant gas which supplies the offgas discharged from the aforementioned reactant gas path to humidification gas and the aforementioned reactant gas path, and humidifies reactant gas.

[0009] Moreover, the humidification gas chamber of reactant gas humidification equipment shall **** to the outlet side of an oxidizer path, and air pole offgas shall be introduced, and it shall form and become so that the reaction air which the humidified gas chamber ****ed and humidified to the entrance side of an oxidizer path may be supplied to an oxidizer path. Furthermore, the humidification gas chamber of reactant gas humidification equipment shall **** to the outlet side of a fuel gas path, and fuel-electrode offgas shall be introduced, and it shall form and become so that the fuel gas which the humidified gas chamber ****ed and humidified to the entrance side of a fuel gas path may be supplied to a fuel gas path.

[0010]

[Operation] In the configuration of this invention, it has a steam transparency layer, and the humidification gas chamber and the humidified gas chamber which were ****ed by this steam transparency layer. By having constituted so that the reactant gas humidification equipment which makes humidified gas the reactant gas which supplies the offgas discharged from a reactant gas path to humidification gas and a reactant gas path, and humidifies reactant gas might be formed The offgas to which the steam partial pressure rose by power generation generation water's serving as a steam, and being applied to reactant gas in a reactant gas path is made into humidification gas. While the closed circuit of the power generation generation water which humidifies non-humidified reactant gas with the steam which penetrated the steam transparency layer using the difference of the steam partial pressure to non-humidified reactant gas, and is supplied to a fuel cell as humidification reactant gas is obtained Since the closed circuit of power generation heat of formation which collects the off-gas heat energy to which generation of heat of a fuel cell was taken and temperature rose to the reactant gas of ordinary temperature through a steam transparency layer can be formed The generation water and heat of formation which a solid-state polyelectrolyte type fuel cell discharges are recycled in reactant gas, and humidification and the function heated beforehand are obtained in reactant gas, without needing an external heat source.

[0011] Moreover, since the amount of reactant gas and off-gas amount which are supplied to a fuel cell always have a proportionality and power generation generation water and heat of formation are also proportional to the amount of supply of reactant gas, the function to perform humidification and the preheating of reactant gas without retardation, without needing a special control is obtained. Furthermore, since the surface area of a steam transparency layer can be easily extended corresponding to the amount of reactant gas, without large-sized-izing reactant gas humidification equipment by folding up and arranging a steam transparency layer for example, to a wave motion type, the function which easy-izes miniaturization of reactant gas humidification equipment and large capacity-ization is obtained.

[0012] The function to prevent xeransis of a solid-state polyelectrolyte layer to an authenticity more is obtained further again by forming reactant gas humidification equipment in any a fuel gas and oxidizer gas side, and preparing both sides.

[0013]

[Example] Hereafter, this invention is explained based on an example. Drawing 1 is the system configuration view in which, and showing it, and omits the duplicate explanation by giving the same reference mark to the same component as the conventional technique. [ the solid-state polyelectrolyte type fuel cell which becomes the example of this invention ] [ **] type ] In drawing, both oxidizer humidification equipments 11 and fuel gas humidification equipments 21 as reactant gas humidification equipment are equipped with the steam transparency layer 12 which ****s the inside of the airtight container in the humidification gas chamber 13 and the humidified gas chamber 14. For example, the Asahi Glass Co., Ltd. make and tradename SUNSEP-W are used for the steam transparency layer 12. In addition, if it constitutes so that it may set in an airtight container where the steam transparency layer 12 is folded up in the shape of a bellow cross parallel, or it may ****

? Similar to Nafion

mutually using the steam transparency layer of two or more sheets, respectively in two or more parallel humidification gas chambers 13 and humidified gas chambers 14, the advantage which can extend the surface area of the steam transparency layer 12 corresponding to the maximum amount of supply of reactant gas, without large-sized-izing an airtight container will be acquired.

[0014] Moreover, the bomb 15 which stores the hydrogen as fuel gas is connected with the fuel gas path 6 by the side of the propellant electrode 3 of the solid-state polyelectrolyte type fuel cell 10 through the regulator valve 16 and the humidified gas chamber 14 of the fuel gas humidification equipment 21, and a fuel gas humidification system is constituted by constituting so that the fuel-electrode offgas discharged from the outlet side may be emitted out of a system through the humidification gas chamber 13 and the relief valve 16. Moreover, the reaction air as an oxidizer supplied by the reaction air blower 18 is connected with the oxidizer path 7 by the side of the oxidizer electrode 4 of the solid-state polyelectrolyte type fuel cell 10 through the humidified gas chamber 14 of the oxidizer humidification equipment 11, and the humidification system of an oxidizer is constituted by constituting so that the air pole offgas discharged from the outlet side may be emitted out of a system through the humidification gas chamber 13 and the relief valve 19.

[0015] Since the power generation generation water which generated the oxidizer humidification equipment 11 by the oxidizer electrode 4 for example, in the oxidizer path 7 of a fuel cell 10 serves as a steam and it is applied to reaction air in the solid-state polyelectrolyte type fuel cell constituted as mentioned above, the steam partial pressure of the air pole offgas discharged from the oxidizer path 7 rises, and the difference of a steam partial pressure occurs between the reaction air which carries out a counterflow contact through the steam transparency layer 12. Moreover, the heat energy of the air pole offgas to which generation of heat of a fuel cell was taken, and temperature rose more than the operating temperature of a fuel cell is transmitted to the reaction air of ordinary temperature through the steam transparency layer 12, and the temperature of reaction air rises even near the operating temperature. Consequently, the steam which penetrated the steam transparency layer 12 using the difference of a steam partial pressure can supply the reaction air near the operating temperature which will humidify the reaction air which is not humidified [ which it preheated near the operating temperature ], and was humidified by the saturation state to the oxidizer electrode 4 through the oxidizer path 7 of a solid-state polyelectrolyte type fuel cell, and can prevent xeransis of an electrode. Thus, according to the oxidizer humidification equipment 11, the power generation generation water and heat of formation of a solid-state polyelectrolyte type fuel cell can be recycled in an ordinary temperature and reaction non-humidified air side, and humidification and the preheating of reaction air can be performed simultaneously.

[0016] Moreover, since the amount of reactant gas and off-gas amount which are supplied to a fuel cell are always in a proportionality and power generation generation water and heat of formation are also proportional to the amount of supply of reactant gas, it is carried out without retardation, without needing humidification of reactant gas, and the control with a special preheating, and the advantage which can supply the reactant gas humidified corresponding to change of a load to a solid-state polyelectrolyte type fuel cell is acquired.

[0017] Furthermore, since the surface area of a steam transparency layer can be easily extended corresponding to the amount of reaction ******s, without large-sized-izing reactant gas humidification equipment by folding up and arranging a steam transparency layer for example, to a wave motion type, the advantage which can carry out [ easy ]-izing of a miniaturization of reactant gas humidification equipment and the large-capacity-izing is acquired. In addition, although the function obtained also about the fuel gas humidification equipment 21 is the same as that of it of the oxidizer humidification equipment 11, the oxidizer path 7 side has many burst sizes of power generation generation water, and a bubbling formula humidifier etc. is formed auxiliary, and since it is few to a fuel gas path side, when the amounts of humidification of the fuel gas by the fuel gas humidification equipment 21 run short, it may be constituted so that shortage of the amount of humidification may be compensated.

[0018]

[Effect of the invention] This invention was equipped with the steam transparency layer, and the humidification gas chamber and the humidified gas chamber which were ****ed by this steam transparency layer as mentioned above, and it constituted them so that the reactant gas humidification equipment which makes humidified gas the reactant gas which supplies the offgas discharged from a reactant gas path to humidification gas and a reactant gas path, and humidifies reactant gas might be formed. Consequently, while the power generation generation water and heat of formation of a solid-state polyelectrolyte type fuel cell are recycled in an ordinary temperature and non-humidified reactant gas side through a steam transparency layer and humidification and the preheating of reactant gas can be performed simultaneously The amount of reactant gas and off-gas amount which are supplied to a fuel cell are always in a proportionality. Since the surface area of a steam transparency layer can be easily extended corresponding to the amount of reactant gas, without being able to perform humidification and the preheating of reactant gas without retardation corresponding to change of a load, without needing a special control, and large-sized-izing reactant gas humidification equipment The trouble in the conventional humidification technique using the bubbling formula humidifier is eliminated. the ** which does not need supply of an external heat source or water -- large-capacity-izing and a miniaturization -- easy steam humidification equipment can be used, the reactant gas which corresponded to change of a load without retardation, and humidified and preheated can be supplied to a fuel cell, and the solid-state polyelectrolyte type fuel cell which can prevent xeransis of a solid-state polyelectrolyte layer can be offered

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